NATURE

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> *"To the solid ground*
> *Of Nature trusts the mind which builds for aye."*—WORDSWORTH

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RETROSPECT AND PROSPECT

IN beginning with the present Number what is practically a New Series of NATURE, the journal has reached a definite stage of its career, one at which it will perhaps not be considered out of place that we should make a reference both to its past and future.

That NATURE has succeeded in attaining the object for which it was started will, we think, be admitted by men of science both at home and abroad; and it is because NATURE has become more and more widely recognised as the organ of science all the world over, that at last we are compelled to enlarge it in order to find space for the stream of communications that week after week come pouring in upon us from all parts. If we have, either directly or indirectly, contributed to this spread of a taste for scientific knowledge, this is due to the untiring assistance and sympathy which the many students and friends of science in this and other countries have afforded us, and which aid we are anxious to take this opportunity of acknowledging. In the future, as in the past, we are sure this stream will continue to flow, so that the editor's function will, as heretofore, be a modest one.

Beyond this we need not dwell on the past and future of the journal. The work accomplished in the past nine years, and the direction in which it has progressed, is a much more important matter. Both writers and readers have, as it were, arrived at a stage of their journey. From it the countries which they have explored are still plainly visible, while those in front of them, never before trodden, even if they show fair promise of being similar to those already traversed, are shrouded in mystery, and may in truth turn out to be very different from what they seem.

We may take advantage, then, of this halt to glance at the nine years' crop of knowledge which NATURE has recorded; to consider the scientific progress accomplished in that period, and to seek for the indications afforded as to the lines along which activity may be expected in the future.

We certainly do live in deeply interesting times. Since the first number of this journal appeared there has undoubtedly sprung up a much greater general interest in science than was formerly to be found, and questions concerning scientific discovery, research and teaching, have now a much more direct interest to the public than they formerly possessed. No better test of this can be required than the continually growing space given to such matters by the daily press, and the more intelligent discussion of such questions as the endowment of research, and the importance of science at our universities and in our schools which is everywhere noticeable.

The matters to which we have just referred are, indeed, those in which a distinct progress has been made—a progress which we firmly believe is only a small foretaste of that which is to follow.

We have, ever since the journal was started, maintained, through evil report and good report, the crying necessity to the country of a greater endowment and a wider diffusion of pure science, because the one provides us with raw material, the other distributes it, so that throughout the length and breadth of the land, new manufactures in the shape of new applications of science may arise. There are many signs which indicate that the necessity of this, which is obvious at the present time only to the comparatively few, will be universally insisted upon. If it is not, future historians may have to show how different might have been our condition if our mental resources, which are doubtless as rich as our material ones, had been utilised in the same way; if education had done for mind, what, for instance, coal has been compelled to do for iron.

The Government has not been slow to recognise this growing interest in scientific matters. In the period to which we refer a commission, of which the Duke of Devonshire was chairman, and of which the two secretaries of the Royal Society were among the members, has gone over, and reported at length on, the whole field of scientific instruction and the advancement of science in the three kingdoms.

The only direct response made up to the present time by the Government to the recommendations of the Duke of Devonshire's Commission, has been the endowment of scientific workers. The sum of 4,000*l.* placed at the disposal of a committee of the Royal Society for this purpose, was doubtless a large sum to begin with, and the committee has made a good beginning with it. The question was a delicate and a difficult one, and allowances must be made, but we doubt whether the intention of the Government will be fulfilled by increasing the stipends of professors who are already hard worked at institutions, the managers of which will now have a most excellent excuse for underpaying them; or by cutting down the personal grants to investigators to provide small sums for apparatus, which the fund was not primarily intended to meet.

Another recommendation of that Commission, namely, the formation of a museum of physical apparatus, complementary to the new museum of Natural History now being erected in South Kensington, has been more than half carried out. A loan Collection of Scientific Apparatus was formed as an experiment, and all, or almost all, have recognised the importance of a permanent museum of this nature.

The Duke of Devonshire's commission has given rise to three others, which have reported on the Universities of England and Scotland; and there is little doubt that out of these labours much good will come, though very likely it will be long in the coming. We say this because such ancient corporations as universities are the products of so many conditions that a mere determination to effect organic reforms, without minute examination, may do much more harm than good. The great point now is that the weak points of our university system are no longer within the ken merely of the few. There are hundreds of thousands of people now in the country who can contrast that getting of knowledge for knowledge sake, which is the glory of the German system, with that utterly demoralising cramming of things that pay in an examination, which is the disgrace of our own. Enough also is known of the activity of the laboratories and scientific workshops in foreign universities to create astonishment at the masterly inactivity in the matter of original work displayed in some of our own. To recognise such defects as these is half to rectify them.

There is now a prospect of science taking its place in our schools alongside of those other branches which until quite recently held exclusive sway in them; and it is probable that in the course of a few years, British schools will have reached the stage attained by German ones a quarter of a century ago.

The foundation of Colleges at Newcastle, Leeds, and Bristol, is among the signs of this increased activity in educational matters, while side by side with these new foundations, Owens College has now arrived at such a pitch of completeness and usefulness that its erection into a university cannot be long delayed. France, as well as ourselves, is now perceiving the advantages of the German system, and before long we may expect to find separate faculties abolished in that country, and the erection of many new universities. That at Lyons is almost already freed from the leading strings of Paris, and others will soon follow.

The Government has been largely influenced in another way—not only, indeed, our Government, but the whole civilised world. Never before in an equal period have so many expeditions been organised to distant parts of the world, to bring back rich fruits of pure knowledge of one kind or another. The voyage of the *Challenger* will for ever mark this century in the history of science, and our country must be congratulated at having so largely helped in the accumulation of the vast stores of new knowledge which that and other similar expeditions have gained for the use of all.

Animal forms new and strange, the secrets of the deepest depth of ocean, the coursing of the blood along the arteries of the world, the building up of a large portion of the planet itself; such are the topics which we shall hear much of during the next years, as volume after volume of these precious records makes its appearance.

It is not the fault of the men of science if the Polar expedition, which our Government, in friendly rivalry with America, Austria, Germany, Sweden, and other countries sent out, will not live so long in story as will the voyage of the *Challenger*. It is, after all, but a grim consolation that the elaborate instructions drawn up, and the valuable series of facts collected for the use of this expedition, will, beyond question, be found useful in a not distant future. The lesson we have learnt, however, goes to strengthen the view so definitely expressed by the German committee, that a mere dash to the Pole is precisely the thing that is *not* wanted. Careful scientific work, chiefly of the physical sort, carried on for a long period of time, and necessarily, therefore, by relays of observers, would in all probability furnish us with a large array of facts, which could at once be applied to the solution of many outstanding questions in various branches of terrestrial physics. The way of the winds alone, in these weirdest regions of the world, in itself presents a problem which may be of the highest importance.

We hope that the enormous sums which have been spent on the observations of the transit of Venus of 1874, will be amply justified by the result which will be obtained when all the observations of Europe and America have been discussed. It remains to be seen whether, when this has been accomplished, the transit of 1882 will have so great a charm for the astronomers as its precursor of 1874. In any case if so much money is to be spent on the determination of a numerical value which can be arrived at by physical means, it is but fair that the interesting physical phenomena which occur during a transit should not be neglected to so great an extent as they were on the former occasion. Those who control expeditions of this kind incur a grave responsibility if any avenue to knowledge is barred by them.

Our first number contained an account of an eclipse of the sun observed in 1869 in America. We commence our eighteenth volume while again in that country astronomers are vying with each other in perfecting their methods to observe the eclipse of next July. Since 1869 our Government has aided three eclipse expeditions: one to the Mediterranean in 1870, one to India in 1871, and one to Siam in 1875. A precedent has therefore been established by which active workers may profit in the coming time, for every solar eclipse and every piece of work at the uneclipsed sun raises questions—and will doubtless for ever go on raising them—which eclipses alone can settle.

Another mark of the recognition of science accorded by our Government has been the increase of the sum placed at the disposal of the meteorological Council, while at the same time a reorganisation of the administration of the Council has taken place. Perhaps the most startling event which has taken place during the last eight years touching the administration of scientific work in England, has been the nomination of the members of this Council by the Royal Society. Among these we do not find one of our distinguished meteorologists. We fear, therefore, that most of the meteorological work of the future will lie outside that body, a result which all must intensely regret, for there is enough loyalty to the Royal Society among British men of science to make them wish that everything it touches should succeed.

Never before have the larger questions of meteorology attracted so many minds: the connection of solar changes with terrestrial changes and everything which depends upon them, is now beginning to loom out of the mists of obscurity in a most gigantic shape. The subject is one of such intense interest to humanity, that here there must be no hasty work. The magnetician, the meteorologist, and the physicist, must march together with cautious tread, and when they do we shall doubtless in the next few years find the basis surer and surer, and the methods employed freer from that mutual criticism which makes outsiders think that meteorological butter depends more upon the churn than upon the milk. In any case we may congratulate ourselves that the next eight years will in all human probability give us a more unbroken chain of solar facts than that secured during the last similar period of time.

It is not only in the larger problems of physical meteorology that progress is being made. Nine years ago found us warning Deal from Valentia. We now, thanks to the public spirit of Mr. Bennett, of the *New York Herald*, warn Valentia from New York. The laws of the passage of storms over the Atlantic will soon, doubtless, be more within our grasp, and the next decade may enable us to watch the travels of a cyclone over a distance equal to half the circumference of the earth.

The Government explorations carried on by the *Challenger* and other expeditions, to which we have already referred, have not been the only ones which made the last decade a very remarkable one.

From the time of Marco Polo nothing more wonderful in the way of foreign travel than the stupendous feats accomplished by Cameron and Stanley in Central Africa have been placed on record. In the near future, and perhaps even in a more distant one, we are not likely to have to chronicle anything coming up to the level of the work accomplished by these men. Nor must we omit to mention Warburton, Giles, and Forrest, whose ride across the Australian desert was scarcely less remarkable. Exploration will doubtless still go on, but by the nature of the problem, it must be exploration of the less sensational sort, but by no means the less useful on that account.

Although these African and Australian adventures have been the greatest achievements of their kind which we have had to chronicle, there is scarcely any part of the world on which the explorer's activity has not recently left his mark. In fact, between Cameron, who makes a dash across a continent, and the much-to-be-pitied members of our own geological survey, who, according to a recent parliamentary paper, spend a year in mapping a region of twelve square miles, there is an unbroken series of workers, thanks to whose labours, *per mare per terras*, a complete inventory of our planetary riches is being got together.

Coming from exploration to the sciences of observation and experiment, when we have referred to the enormous increase in telescopic power on the one hand, and to the gradual consolidation and new grouping of facts on the other, we have, perhaps, referred to the most salient points. The increase of observing power since 1869, as is best evidenced by the discovery of two satellites of Mars, is simply stupendous; in that year we chronicled the erection of the Ferndene telescope; since then this telescope has not only been eclipsed actually, but in imagination dwarfed into such dimensions that it may serve as a finder to the telescope of the future. Henceforward the attempts of those who experiment on 10-feet mirrors will be the central point of interest.

The development which our knowledge of the motion of the intimate particles of matter has received during the last ten years from the work done on the kinetic theory of gases and in the exploration of spectroscopic phenomena, is greater than we have as yet any idea of. It will not be a surprising thing if, before very long, these two streams of work find their meeting-place as do the Rhône and the Saône at Lyons, when the clear formulæ of the kinetic theory, commingling with the already multitudinous but far from organised spectroscopic observations, shall form a noble river, the molecular science which in the coming time will embrace all others.

Another grouping, of which we have recorded the gradual consolidation, and which is destined to change the points of view from which many Aspects of Nature have been regarded, is that of physiography—a name which conveniently defines the region where the physicist, the chemist, the geologist, and the astronomer, find each a common interest. Such a grouping as this would, of course, be impossible in a planet where the chemistry of extraneous matter, or the origin of its own, presented problems beyond the range of investigation. But precisely because such points as these are continually receiving important developments here, this new grouping is destined to form a centre of an ever-widening interest —an interest from which all must gain, for so surely as all Nature is one, so must the work of each explorer, to be of its greatest value, form only a part of one combined attack.

The radiometer and the telephone are products of recent investigations in physics which of themselves are fit to mark an epoch, but first-rate work has been done besides, by which the continuity of the gaseous and liquid states of matter has been demonstrated, and the last gas reduced to a liquid form. The revival of the contact theory affords a new standpoint for electricians, while the ever-increasing analogies between light and magnetism which are being brought forward indicate that before long some vast generalisation may be expected in this direction. On all sides the interest attaching to physical problems is increasing, and it is well that this is so, because the chemists among us are for the most part silent, and chemical theory is almost dead in England; indeed it would appear as if the centre of gravity of this science had gone bodily eastward, and Berlin and St. Petersburg now replace London and Paris so far at all events as organic chemistry is concerned.

But if the chemist has ceased to employ physical tools this is made up for by those large fields of physical work which are being more and more utilised by the physiologist. The introduction of physical methods into biological research is one which has already borne, and which will in the future bear, rich fruit, and all work of one kind in this direction will be as largely modified in the future by the introduction of physical methods as that of another will be rendered practically a new science by the generalisations of the immortal Darwin.

All experimental science will gain by this, for each branch of scientific work reacts upon all others, and while in the future a physiologist who simply knows how to use a microscope and a dissecting knife will be an impossibility, physics, on the other hand, will be sure to receive new methods of observation and new instruments from those who have been compelled to invent them for their new needs.

We have recorded the completion of, perhaps, the greatest work ever undertaken and carried to a conclusion by any one man. We allude to the planetary tables, the final touches of which were added by Leverrier only a few hours before a death which has left a void in science which it may take centuries to fill.

The physical side of geology has attracted much attention during the last nine years, and it has been our privilege to chronicle many investigations dealing with the interior structure and heat and the probable age of our planet. The facts collected by our surveyors with an activity which, especially in America, has been something beyond all parallel, thus find themselves supplemented by theoretical views, the fitting together of which, in the future, will be a work which will be second to none in interest.

Of practical applications of science made since 1869 the number is legion, and some are of high order. The advance in navigation, perhaps, is the most striking. We have not only in the way of new instruments the bathometer, a machine for taking flying soundings, and a perfect compass, but also the whole art of navigation promises to be revolutionised by the introduction of new methods. One thing which all friends of science should take to heart, has been abundantly established, the science most applied is the science of which the theory is bound to receive the greatest development. The telephone, duplex telegraphy, steam fog-signals, and the application of electricity to lighting, must also be mentioned.

From the prosecution of science itself we must turn to some of its surrounding conditions. We have had to watch, and have recorded with pleasure, the establishment of several new societies, and the strengthening of old ones since our first number was issued. Mathematicians have now a strong society; physical science is now represented in this way by the side of chemistry; while the latest born of these societies, though by no means the least active, is that devoted to mineralogy. We do not suppose the coming time will see a very large increase in the number of these bodies, but we think that it certainly will see a considerable influence of them all upon the Royal Society. It would be a loss universally deplored if the Royal Society were to abate one jot or tittle of its influence, but with active societies all round it representing each branch of inquiry and at once discussing each advance of knowledge in full meetings, it is difficult to understand that the Royal Society may not suffer if some better method than the one at present adopted of providing for the reading of the multitude of papers presented to it is not adopted.

From our own English societies we once more come to individuals, and here our task is a sad one. It is almost impossible to name a period of nine years during which death has played such havoc among men of science of all nationalities. Herschel, Graham, Wheatstone, Sedgwick, Lyell, and Murchison are no more; Leverrier, the great Leverrier, has gone with Regnault, Milne-Edwards, Claude Bernard, Becquerel, and many other Frenchmen of note. America has lost Agassiz; Germany, Liebig, Argelander, Erdmann, Mayer, and Heis; Russia, von Baer and Mädler; Italy, Secchi; while in all countries the thinning of the ranks of men of lesser note has been disastrous. We may surely hope that in our new series the sad task of bidding farewell to men who have done their work in science may fall less frequently upon us.

EDITOR

THE AMERICAN STORM WARNINGS

THE interest excited in Europe, and particularly in England and France, by the weather predictions cabled by the *New York Herald* to its London Office during the past year (commencing February 14, 1877) proves that these warning messages are regarded as important to the interests of commerce, navigation, and agriculture. The generally expressed opinion as to their accuracy is a favourable one, and is justified, I believe, by the fulfilment of a very large percentage. Such a result of the first year's work affords me unqualified satisfaction. It represents all the success I aimed to attain, and much more than I hoped to win.

I will state at the outset that the carrying out of the whole project of warning the European coasts of the approach of storms has depended on, and has been sustained by, the munificence and generous enterprise of Mr. James Gordon Bennett, the proprietor of the *New York Herald*, whose encouragement and support of every undertaking calculated to promote the advancement of science and discovery are well known and appreciated. The work accomplished so far is the result of some years' study of the phenomena of atmospheric movements. The deductions, therefrom, I have endeavoured to reduce to a practical application in these cabled weather-warnings of the *New York Herald*. In this, I believe, a useful step has been made in meteorological inquiry, which may lead to greater and more definite results.

Before February 19th, 1877, the day on which the first weather warning of the *New York Herald* (sent on the night of the 14th) was fulfilled, the question as to the possibility of establishing a reliable connection between